① Intro

② Sennheiser HD800 $1500 - $2000
- According to several reviews one of the best
- Low mass low distortion ring radiator drivers
- Comfortable large footprint earpads

③ Beyerdynamic T1 $1300
- To compete with the Sennheiser HD800
- Reviews not quite as good as HD800

④ Beyerdynamic T5P $1300
- Similar to T1

⑤ Audeze LCD-3 $2000
- Reviewed as one of the best headphones
- Planar magnetic, light diaphram
- On par with Sennheiser and Beyerdynamic

⑥ Stax SR-009 $5500
- One of the best electrostatic headphones
- Requires the best headphone amp of $\simeq$ $5000

⑦ Taket h2+ $2000 + $1200 for transformer box

- Heil type polymer piezoelectric drivers
- Built-in ribbon super tweeters
- Needs transformer / power supply box (extra)
- Seems to require separate EQ
- Reviewed as one of the best sounds

⑧ Fostex TH-900 $2000

- Well reviewed as good natural sound
- Not fatiguing and comfortable
- Too much detail in reviews about the finish of materials used.

⑨ Minimax amp.

- Note anti-vivration rings on valves

⑩ Little Dot

- Note the “bomb proof” valve protection

⑪ Musical Paradise MP-301 MK3

- High power for headphones or speakers
- Exposed power supply caps - not a good look

⑫ Decware Taboo MKIII
- Note valve rectifier
- Current meters for each channel.

⑬ ALO Pan Am and DAC
- Multiple input including USB
- Inbuilt DAC

⑭ CMoy Freeform
- Minimalist components
- In - Out - Power
- Dual opamp, 3 resistors & 1 capacitor per channel

⑮ Clear potted version of CMoy
- Something to gaze at while listening
- Nice AKG headphones in photo

⑯ Sennheiser Orpheus headphones and amplifier
- Nice amp with bomb proof valve covers
- Nice price  $17,000
- Orpheus headphones discontinued

⑰ Questions for Audience (homework)

⑱ Blumlein's binaural patent 1931

- Note baffle between microphones
- Note baffle between speakers
- Shuffle circuit 'C" early form of cross feed, M-S, binaural/stereo
- Blumlein > 100 patents
- "I have a way to make the sound follow the person"
- Add an extra optical sound tarck to film for S info' as in M-S micing

⑲ Near and far acoustic paths

- Amplitude and delay to opposite ear.

⑳ Crossfeed to opposite earphone

- Electronic cross over signal to opposite earphone
- Compensation for distance to opposite ear
- Compensation for influence of head (nose etc)

㉑ Listening to Loudspeakers Vs Headphones

- Both ears hear both speakers
- Left ear hears left channel and vice versa
- At the position shown : more sound via speakers
- This causes less sound from this position using headphones

㉒ Interchannel level difference

- The ear closer to the speaker has more sound level

㉓ Frequency response

- Shows difference in frequency response to each ear
- Is difference to far ear at “notch” frequency due to nose?

㉔ Inter-channel time difference

- The ear farther from the speaker has a delay in time

㉕ Time difference at $30^0$ off axis

- Changes at approximately one kilohertz

㉖ Cross feed amplifier

- Has adjustments for speaker angle
- Adjustment for cross feed level

㉗ Stereo Widening System

- Uses three circuit blocks :-

## ㉘ Difference Circuit

- Inverts one channel, then adds
- Then delays this difference signal
- Then filters this signal
- The re-inserts this combined difference signal

## ㉙ Cross-feed circuit

- Uses frequency and amplitude shaping to other channel

## ㉚ Early Reflection Circuit

- Using filtering and delay for each channel

## ㉛ A solution to the middle-of-head problem

- My system uses a delay in each channel with some level of bypass
- A combined lower amplitude signal is recombined in each channel
- This gives a low level pre-delayed signal to both ears
- This signal is between 8 & 16 dB lower and ahead of the delayed signals by 10 to 30mS
- This preconditions the brain before the full stereo signal and positions the sound away from the middle of the head.
- A refinement has another shorter delay in parallel with the common channel and allows for a longer delay time in each main channel
- The cross feed system is also used at the headphones

## ㉜ My notes